UTAH DEPARTMENT OF TRANSPORTATION

TECHNICAL BULLETIN MT

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Bonded Wearing Course Application

BONDED WEARING COURSE

A Bonded Wearing Course (BWC) is a gap or open graded, thin hot-mix asphalt (HMA) mixture applied over a thick polymer modified asphalt emulsion membrane. The emulsion membrane seals the existing surface and produces high binder content at the interface of the existing roadway surface and the gap or open graded mix all in one pass. The gap-graded and open-graded mixes provide an open surface texture to allow water to flow through the surface. BWC can be applied and opened to traffic quickly. Bonded Wearing Courses are primarily used in high traffic areas as a surface treatment over HMA and Portland Cement Concrete (PCC) surfaces. It can be placed over structurally sound pavements as a maintenance treatment, and may also be used in new construction and rehabilitation projects as the final wearing course. The life expectancy for a BWC is 7 to 12 years before another preservation project will be needed.

The Polymer Modified Emulsion Membrane (PMEM)
The Bonded Wearing Course PMEM seals the existing pavement and bonds the gap-graded or open-graded mix to the surface. The thick nature of the membrane allows it to migrate upwards into the mix, filling voids in the aggregate and creating an interlayer of high cohesion that does not delaminate or bleed, when applied correctly.

The emulsion applicator is part of the paving equipment and applies the PMEM at a temperature between 120° and 180°F at the specified application rate. The application rate should be adjusted according to the surface being covered according to the following table. For more absorbent, textured or badly pocked pavement surfaces, the application rate is increased. The application rate is reduced for smooth or flushed AC pavements. Typically PCC pavements require less emulsion membrane than AC pavements.

If the screed extension is outside the spray bar width, the polymer modified emulsion membrane will need to be applied manually to coat the pavement between the end of the spray bar and the end of the screed. Care should be taken to ensure the correct application rate in such circumstances. The spray bar should be calibrated and able to be adjusted to within ± 10% of the design application rate. Coverage of the pavement must be even and uniform and, as such, it is important that there are no plugged nozzles on the spray bar.

Polymer Modified Emulsion Membrane Application Rate Table

Surface to receive PMEM	*Actual Field PMEM Rate (Gallons/Square Yard)*
PCC Pavement	0.12 to 0.16
Dense, Compacted, New/Existing HMA Pavement, or Milled Surface	0.17 to 0.21
Open Textured, Dry, Aged or Oxidized AC Pavement	0.20 to 0.26

The Asphalt Mix
The BWC gap-graded or open-graded mixes provide a stone on stone contact which is resistant to rutting within the mix. The finished mat has very high macro-texture properties, provides good skid resistance, and has a void structure that improves driving visibility by reducing back-spray and tire-splash over dense-graded mixes. The void structure also reduces tire noise. The mix is generally laid two times as thick as the largest stone in the gradation; however, it may be placed thicker to correct minor surface irregularities and as thin as one and a half times the maximum aggregate size.

Mix Properties
The BWC mix may be placed with three different mix gradations; Type A, Type B, and Type C. Type A is placed at 65 pounds per square yard with a minimum of 5/8" thickness. Type B is placed at 75 pounds per square yard with a minimum of ¾" thickness. Type C is placed at 95 pounds per square yard with a minimum of 1"thickness. The typical BWC mix placed in the Utah climate is Type B at 1 inch thickness. In warmer, dryer climates, Type C can be utilized as well.

Paving
Good paving practice should always be followed when constructing a BWC. Windrowing and pick up machines are not allowed for constructing bonded wearing courses. The trucks servicing the paving unit should operate in a smooth manner, causing no bumps and allow paving to proceed continuously to create a smooth ride.

The minimum delivery temperatures are very critical to successfully placing BWC. Minimum temperature guidelines specified in the respective specifications need to be followed. Placement should not be allowed if BWC temperatures behind the screed fall below 285°F due to the propensity of the freshly laid mat to result in shadowing, dragging and raveling.

The surface should be prepared before BWC placement. Pavement cracks should be clean or routed and sealed flush with an approved hot applied crack sealing material and joints greater than ¼ inch. No over banding greater than 2 inches should be permitted.

Longitudinal joints should be straight or correctly aligned to the curvature of the roadway, and should occur only at the edge or center of a traffic lane and never in the wheel paths. Unlike traditional paving, miscellaneous areas, turn lanes, and handwork areas should be paved before paving main line.

Variable width shoulders with a cross slope or grade break in excess of 3% may require different paving techniques. A shoulder backing machine has proven to be very successful using the BWC material. Depending on the project, it can be used to meet grade by paving the main line and then the shoulder or the shoulder and then the main line.

SPECIFICATIONS/DETAILS
The UDOT Specification Number and Title is 02787 – Bonded Wearing Course (BWC).

COST INFORMATION
The average unit bid price for BWC in 2009 was $5.58 per square yard for a total of 1,568,069 square yards on 8 projects. For the first half of 2010, it was $3.95 per square yard for 327, 861 square yards on two projects.

FURTHER INFORMATION

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